SECTION 13955

WET PIPE FOAM WATER FIRE SUPPRESSION SPRINKLERS

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LANL MASTER CONSTRUCTION SPECIFICATION

When editing to suit project, author shall add job-specific requirements and delete only those portions that in no way apply to the activity (e.g., a component that does not apply). To seek a variance from applicable requirements, contact the Engineering Standards Manual (ESM) Fire Protection POC.

When assembling a specification package, include applicable specifications from all Divisions, especially Division 1, General Requirements.

Delete information within “stars” during editing.

Specification developed for ML-3 / ML-4 projects. For ML-1 / ML-2, additional requirements and QA reviews are required.

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As a minimum, include the following specifications in bid package.

01090	Reference Standards
01330	Submittal Procedures
01325	Water Discharge Requirements
01630	Product Options and Substitutions
01700	Contract Closeout
01720	Project Record Documents
Div. 13	Applicable fire alarm specifications
15075	Mechanical Identification
15141	Disinfection of Potable Water Piping
15922	Testing Piping Systems

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PART 1 GENERAL

1.1 SECTION INCLUDES

A. Scope of Work: Provide design, shop drawings, project record drawings (as-built), equipment, fabrication, labor, transportation and supervision necessary to install, flush, test and place into service a complete hydraulically designed automatic wet pipe foam water sprinkler system.

B. Components: System shall consist of, but not be limited to, interconnecting piping, fittings, control valves, check valves, backflow preventers, alarm valve with trim, foam concentrate valves, foam concentrate, foam concentrate tank, proportioner and associated equipment, fire department connection, sprinkler heads, hangers, bracing, inspector's test station drains, sprinkler alarm and other devices for a complete installation in accordance with codes, standards and recommended practice referenced in this Section.

1.2 DESIGN

A. Design system in accordance with NFPA 13 and 16.

1. Minimum classification Ordinary Hazard Group II or as specified by the LANL Fire Marshal.

2. Conform to extra or special hazard requirements where required or indicated.

3. Conform to NFPA 13 for storage occupancies with potential storage height greater than 12 feet and other special hazard occupancies.

4. System to operate at 7500 feet altitude.

5. Provide necessary devices to separate system into individual and distinct alarm zones. Provide a minimum of one zone per floor.

B. Seismic Design: Protect automatic sprinkler system above grade to prevent pipe breakage in accordance with NFPA 13 and this specification.

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Use PC-2 (use PC-3 for ML-3 and PC-4 for ML-4). Reference DOE STD 1020
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1. Seismic Performance Category: [ ]. Follow Engineering Standards Manual, Structural Chapter, to determine extent of seismic protection.

1.3 SUBMITTALS

A. Submit the following in accordance with Section 01330, Submittal Procedures:

B. Hydraulic Calculations prepared in accordance with NFPA 13 and 16. Submit calculations with shop drawings.

1. Base pipe size adjustment on maximum variation of 15 percent above specified discharge rate per sprinkler or nozzle in accordance with NFPA 16.

2. Calculate demand point for each system so that it remains a minimum of 5 psi below design basis water supply curve. Design basis water supply curve shall be after required 500 gpm hose streams and friction loss to base of riser have been deducted.

3. Include in calculations elevation differences between point of water test and base of riser. Include graphical representation of design basis water supply curve and system demand.

4. The following preliminary flow data is provided to the Contractor for bidding purposes: static _____ psig, residual _____ psig, flow _____ gpm, hydrant number ____ , hydrant elevation _____ feet.

5. Base system design on actual flow information provided by LANL. Request actual flow data in a timely manner to maintain project schedules.

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Static seismic calculations are not required if performance category is PC-2, Instead, comply with standard NFPA 13 requirements for protection of piping. Dynamic seismic calculations are required if performance category is PC-3 or PC-4. Reference Section 1.2 for performance category.
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C. Seismic Calculations:

1. PC-2

a. Provide earthquake sway bracing in accordance with NFPA 13.

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OR
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1. PC-2 or PC-3

a. Provide calculations based on a dynamic analysis certified by a registered professional engineer with expertise in dynamic seismic analysis. Calculate in-structure response for the system such that performance of system within structure meets the required performance category criteria in DOE STD 1020 as well as NFPA 13.

b. Provide qualifications of dynamic analyst and documentation of computer software systems for review and approval by LANL.

D. Catalog Data with selected options noted.

E. Certifications for welders in accordance with NFPA 13.

F. Installation Instructions.

G. Materials Part List (Bill of Materials) with manufacturer, model number, and quantity.

H. Shop Drawings using a minimum scale of 1/8" = 1'0" for plans and 1/4" = 1'0" for details. All lettering shall be a minimum of 1/8 inch high.

1. Show information required by NFPA 13 and NFPA 16, including piping, sprinklers, hangers, flexible couplings, foam components, roof construction, electro-mechanical devices, occupancy of each area, and ceiling and roof heights.

2. Base working plans on actual survey of existing conditions.

3. Show hydraulic reference points and remote areas.

I. Test Reports

J. Operation and Maintenance Manual: Submit system description, system final inspection and Contractor's material and test certificates per NFPA 13 and NFPA 16, of the completed system project record documents.

1. Include in operation and maintenance manuals, instructions, a brief description of type of system installed, routine maintenance work defined by step-by-step instructions, and recommended frequency of performance.

2. Also include in instructions, possible malfunctions with diagnostic methods and suggested correction of each.

3. Describe function of each component or subassembly.

K. Project Record Drawings (As-Built): Provide updated shop drawings on CD’s and prints reflecting as-built conditions showing Work completed under this Section.

1. Base as-built drawings on actual survey of the completed installation.

2. Include notes on all special systems or devices such as dry pendent sprinklers, antifreeze loops, inspector's test stations, and foam making components.

3. Provide revised hydraulic calculations demonstrating water supply restrictions have not been exceeded when conditions of installation are different from those anticipated during preparation of Project Record Documents.

4. List recommended spare parts (manufacturer, model number, and quantity).

1.4 QUALITY ASSURANCE

A. Provide proof that installation firm has satisfactorily performed at least ten projects of equivalent nature and scope of the Projects herein; and is licensed within the USA to engage in design, fabrication and installation of automatic sprinkler systems for fire protection.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Materials and Equipment: Protect materials and equipment from damage during shipping, storage and installation.

B. Plugs and Cover Plates: Protect threaded ends, flanged openings with gasketed metal cover plates to prevent damage during shipment and to prevent foreign materials from entering. Cap or plug drains, vents, small piping, and gauge connections.

PART 2 PRODUCTS

2.1 PRODUCT OPTIONS AND SUBSTITUTIONS

A. Comply with Section 01630, Product Options and Substitutions.

2.2 DESIGN

A. Provide new fire protection materials and equipment, UL Listed or FM Approved, conforming to requirements of NFPA 13 and 16.

2.3 PIPING AND FITTING MATERIALS

A. Provide in accordance with this Section, NFPA 13 and 16, except that piping 2 inches and smaller shall be Schedule 40 minimum.

B. Piping material shall be compatible with foam concentrate, do not use galvanized piping inside building.

2.4 VALVES AND STRAINERS

A. Provide Listed or Approved valves and strainers rated at 175 psi or greater working pressure.

B. Check Valves: In sizes 3 inch and larger, provide 3/4 inch NPT drainage taps.

C. Strainers: Provide "Y" type strainers with cast iron body and 30 mesh stainless steel screen.

D. Alarm Valve: Minimum acceptable size is 4 inches. Provide retardant chamber, 2 water pressure gauges and necessary valves and trim for alarm valve operation.

1. Provide bypass valve in trim to allow test operation of pressure alarm switch without tripping valve clapper.

2. Equip alarm valve with retard chamber and pressure alarm switch with one normally closed contact, suitable for 24 VDC.

3. Provide check valve in retard chamber drain line when retard chamber drain line ties into main riser drain.

2.5 PRESSURE GAUGES

A. Provide Listed pressure gauges designed for use with air or water.

1. Gauge Scale: Dial marking subdivision no finer than 1 percent of maximum scale reading and accurate to 3 percent or less. Provide minimum scale range twice the maximum working pressure (when possible).

2.6 VALVE SUPERVISION (TAMPER SWITCHES)

A. Equip valves which control water to automatic sprinkler heads with supervisory switches.

1. Provide valve supervisory switches with single pole double throw switching contacts, housed in gasketed weathertight enclosure, suitable for 24 VDC.

2. Supply supervisory device specifically designed to mount on, and operate reliably with, type of control valve being monitored.

3. Adjust valve position switches to transmit a supervisory signal within two revolutions of valve operating hand wheel or crank (away from its full open position).

4. Provide alarm control valve with supervisory switch, Potter Electric part number BVS, or approved equivalent, suitable for 24 VDC.

2.7 WATER FLOW SWITCHES

A. Provide Potter Electric vane-type flow switches, or approved equivalent, with field adjustable pneumatic retard and 175 psi working pressure.

1. Use single pole double throw, normally open switches, suitable for 24 VDC.

2.8 SPRINKLERS AND ACCESSORIES

A. All sprinklers shall be Listed by a nationally recognized testing laboratory and shall be selected in accordance with their Listing, manufacturer's instructions, and applicable NFPA requirements. Provide sprinklers as follows:

1. Upright Sprinklers: Brass upright type. Use in areas without suspended ceilings.

2. Pendent Sprinklers: Chrome plated. Use below suspended ceilings.

3. Sprinkler Guards: Provide where sprinklers are exposed to external damage.

4. Corrosion-Resistant Sprinklers: Provide in locations where chemicals, moisture or other corrosive vapors exist.

B. Where indicated, provide other types of sprinklers in accordance with their Listing.

2.9 WATER SHIELDS

A. Provide in areas where there is no ceiling, and when multiple level protection is required, e.g., at open grating or open high roofed areas.

1. Provide compatible Listed/Approved water shields and/or intermediate level sprinklers in accordance with NFPA 13

2.10 FIRE DEPARTMENT CONNECTIONS

A. Provide fire department connections with 4 inch minimum outlet, two 2-1/2 inch minimum inlets, National Fire Standard threads, cast brass body, clapper in each inlet, plugs, and attached chains.

1. When wall-mounted, locate pumper connections on blank masonry wall, or provide wall with one hour fire barrier for 10 feet in all directions from pumper connection, and identify automatic sprinkler connection.

2. Identify individual devices by raised letters on the individual devices, or attach escutcheon plates of same material.

3. Locate 34 inches (plus or minus 2 inches) from grade level to center of inlet connection.

2.11 SPLASH BLOCKS

A. Provide concrete splash blocks, approximately 12 inches by 24 inches by 4 inches thick.

2.12 ANTIFREEZE LOOPS

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Provide a backflow preventer (BFP) in the antifreeze loop when a BFP is not installed in the sprinkler riser supplied from a potable water system. Systems supplied from a dedicated loop or tank (non-potable water) do not require backflow protection.
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A. Provide antifreeze loops with solutions of propylene glycol with corrosion inhibitor and water as described in NFPA 13, prepared with a minimum freezing point of minus 40 degrees F.

2.13 FOAM-CONCENTRATE EQUIPMENT

A. Foam-concentrate equipment, including concentrate, storage tank, proportioner, pump (if required), and associated components and/or devices, shall be capable of supplying 3 percent by volume of AFFF foam concentrate to pre-primed wet pipe sprinkler system for the design density over the design area for minimum period of 20 minutes.

1. Do not use hose demands in calculation of foam quantity required.

2. Foam concentrate used for priming shall be in addition to the application quantity.

3. Provide 100 percent reserve of foam concentrate in 5 and/or 55 gallon containers.

4. Use pressure proportioning tanks injection method foam equipment. Provide epoxy coated ASME Code stamped pressure tanks. For systems requiring foam concentrate pumps, provide factory fabricated skid mounted unit containing necessary components including control valves, proportioner, in line inductor, interconnecting piping, and water flush-out connections.

2.14 SPRINKLER RISER BACKFLOW PREVENTER

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Provide a backflow preventer in a new system when the fire protection system is supplied from a potable water system. Systems supplied from a dedicated fire loop or tank (non-potable water) do not require backflow protection. Refer to Fire Protection Standard Drawing ST-D4010-1 (formerly ST2010) for riser detail with backflow preventer.

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A. Manufacturers:

1. FEBCO, Model 880V.

2. Wilkins, Model 475V.

B. Reduced pressure type, vertical orientation, ductile iron body epoxy coated internal and external, with UL/FM OS&Y gate valves, flanged ends, test cocks for in-line field testing, pipe support adaptor, and air gap drain kit. Maximum water temperature range 33 to 140 degrees F, maximum rated working pressure 175 psi. Assembly shall be Listed in the latest edition of Approved Backflow Prevention Assemblies by the University of Southern California Foundation for Cross Connection Control and Hydraulics Research. Size to match alarm check valve.

PART 3 EXECUTION

3.1 EXAMINATION

A. Prior to installation carefully inspect installed Work of other trades, whether pre-existing or part of this Project, and verify that such work is complete to the point where installation of sprinkler system may start.

B. Notify the Contract Administrator should conditions exist, not resulting from Work of this Project, that prohibits the installation from conforming to referenced codes, regulations, standards and approved design.

C. Install materials and equipment that are free of moisture, scale, corrosion, dirt and other foreign materials.

3.2 INSTALLATION

A. General:

1. Install closed head foam-water system in accordance with NFPA 13 and 16.

2. Do not locate sprinkler heads closer than 12 inches to supply air registers.

3. Visually examine pipe, fittings, valves, equipment and accessories to ensure they are clean and free of burrs, cracks and other imperfections before installation. Clean pipe interiors by flushing.

4. Verify dimensions in field.

5. Drawings show only approximate building outlines and interior construction details as an aid in understanding the scope of Work. Investigate structural and finish conditions affecting the Work and arrange Work accordingly, providing such sprinkler heads, fittings, traps, draining valves, piping, and accessories as required to meet such conditions. Show relevant structural details on Drawings.

6. Do not render inoperative any system without the prior approval of the Contract Administrator. Coordinate necessary shutdowns of existing systems by notifying the Contract Administrator a minimum of 7 working days before rendering such systems inoperative.

7. Coordinate sprinkler piping, sprinkler heads and associated equipment with existing ceiling or roof materials, lighting, ductwork, conduit, piping, suspended equipment, structural and other building components.

8. Dispose of equipment removed for completion of this Project as directed by the LANL Construction Inspector.

9. Provide access openings in areas where concealed sprinkler piping is installed.

B. Piping:

1. Provide 1 1/2 inch foam test header downstream of foam proportioner, and pipe to exterior of building.

2. Mark and identify sprinkler piping in accordance with Section 15075, Mechanical Identification.

3. Conceal sprinkler piping in areas with suspended ceilings. Install piping in exposed areas as high as possible using necessary fittings and auxiliary drains. Keep sprinkler piping a minimum of 7 feet 6 inches above finish floor. Where not possible, run piping at same elevation as existing piping and ducts. Obtain prior approval from the LANL Construction Inspector.

4. Install Inspector's Test piping at the hydraulically most remote point of the automatic foam water sprinkler system and discharge to exterior of building. Where possible, conceal test piping in wall and provide access panels for valve and sightglass and protect from freezing. Locate inspector's Test Station in an easily accessible location approved by the LANL Construction Inspector.

5. Diamond coredrill or sleeve concrete penetrations, then grout and seal with fire-resistive material, securely held in place. Use Listed/Approved through penetration fire stop system assemblies for piping penetrating fire resistance rated construction.

C. Pipe Support: Install pipe hangers for pipe supports inside buildings in accordance with NFPA 13. Install concrete anchors by drilling, using UL Listed or FM approved anchors. Do not use explosive-driven fasteners as a method of installing anchors or hangers. Do not hang other piping or equipment from sprinkler pipe.

D. Welding:

1. Shop weld pipe and fittings using approved welding fittings. Comply with NFPA 13 for welding methods.

2. Provide a blind flange or grooved cap at each end of welded headers.

3. Use certified welders. Check certificates before Work commences.

E. Alarm Valve: Set plumb and unobstructed. Provide minimum clear distances from walls to centerline of alarm valve as follows:

1. Rear - 12 inches

2. Sides - 20 inches

3. Front - 36 inches

F. System Riser: Install riser from underground so that no joint or fitting occurs within the bearing zone of foundation structures or occurs at least 5 feet from any foundation structure.

G. Control Valves: Provide Listed OS&Y fire protection control valves. Installed so open or closed status can be readily seen from finish floor.

1. Install control valves on supply lines (outside protected area) into elevator shaft and elevator equipment room, computer rooms, and identified special protection areas. Control valve to be accessible from floor level. Provide valve with tamper supervision switches.

H. Sprinklers and Accessories:

1. Provide upright sprinklers on exposed piping below ceiling. Pendent type heads may be used where necessary due to spacing, location, and position requirements.

2. Provide chrome plated pendent heads, recessed, or flush mounted heads below finish ceilings. Route supply piping above ceiling.

3. Align sprinklers below ceiling parallel to ceiling features and walls, and locate as close to center as possible in halls and corridors.

4. Provide chrome-plated escutcheons where exposed piping passes through finished floors, walls, partitions and ceilings. Secure to pipe with set screws or spring clips.

5. Protect sprinklers subject to mechanical injury with guards as follows:

a. Provide guards in mechanical equipment rooms, electrical equipment rooms, janitor's closets, and storage areas where distance from sprinkler deflector to finish floor is less than 15 feet.

b. In all other areas, provide guards where distance from sprinkler deflector to finish floor is less than 7 feet.

6. To prevent freezing, extend dry pendant sprinklers a minimum of 6 inches into heated area before connection to wet sprinkler piping.

7. Provide one spare sprinkler cabinet, complete with sprinklers of assorted temperature ratings of the type necessary and in use throughout the installation, at each main riser valve. Equip each cabinet per NFPA 13.

I. Signs:

1. Install as required by NFPA 13.

J. Painting: Paint sprinkler risers, unfinished pumper connection piping, exposed sprinkler piping in stairwells, and sprinkler piping in all equipment rooms with 2 coats of Fire Protection Red. Apply one coat of primer and one coat of paint to match background, on new exposed piping in occupied spaces. Do not paint automatic sprinkler heads.

K. Unsupervised Water Supplies: Install approved water flow detection device on underground water supplies entering buildings when fire protection riser is more than 10 lineal feet from exterior of building.

L. Water Supply Control Valve: Where not otherwise provided for, provide water supply control valve(s) conforming to the requirements of NFPA 24.

1. Provide UL Listed or FM Approved valves, with Listed indicating post. When possible, locate valve at least 40 feet from building.

2. When valve is located less than 20 from building, or a wall post indicating valve is provided, the wall 10 feet in all directions of the valve shall be blank masonry or one hour fire resistance rated construction.

M. Special Tools and Devices: Provide one complete set of special tools or special devices required for operation, testing and/or maintenance of equipment furnished under this Section.

3.3 EQUIPMENT INSTALLATION

A. Install devices or equipment not specifically covered by these Specifications in accordance with manufacturer's instructions.

3.4 CONNECTIONS TO EXISTING SYSTEMS

A. Final connection of new systems to existing underground piping systems will be made by LANL’s SSS with materials furnished by the Contractor.

B. Final connection of new systems to other existing systems above grade shall be done by the Contractor after contacting the LANL Construction Inspector who will implement the LANL Fire Protection Impairment Procedure. Do all final connections of this type with only one outage per existing system.

3.5 STERILIZATION

A. Sterilize sprinkler system underground piping upstream of the backflow preventers in accordance with Section 15141, Disinfection of Potable Water Piping.

B. Do not sterilize sprinkler system downstream of backflow preventers.

3.6 EXISTING CONDITIONS

A. Area Restoration: Restore areas disturbed by the fire protection system installation to the condition existing prior to start of construction.

B. Field Inspection: Field inspect areas of sprinkler installation for potential interference with ducts, cable trays, electrical or mechanical equipment, and other similar interferences. Carefully coordinate Work under this section with other Work.

3.7 TESTING

A. Hydrostatically test piping in accordance with Section 15992, Testing Piping Systems, and NFPA 13.

B. System test discharging foam in accordance with NFPA 16.

1. Verify foam concentrate consumption rate by refractometric means.

C. Flush system with water after operation with foam in accordance with NFPA 13 and 24.

1. Comply with the discharge requirements in Section 01325, Water Discharge Requirements.

D. Notify LANL Construction Inspector at least 5 working days in advance to witness tests.

3.8 INSPECTION

A. Inspect new fire protection system in accordance with NFPA 13, 16 and 24, in the presence of the LANL Construction Inspector. Give advance notice, as specified below, to the LANL Construction Inspector prior to any tests.

1. Notify the LANL Construction Inspector upon completion of installation of all materials and equipment. LANL will schedule inspection of installation within 5 working days after Contractor notification.

2. Correct deficiencies noted during this inspection and correct prior to further testing.

END OF SECTION

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Do not delete the following reference information:
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FOR LANL USE ONLY

This project specification is based on LANL Master Construction Specification Rev. 3, dated October 1, 2003.